

STUDY MATERIAL

- **Difference Between Research Method and Research Methodology**
- **Factor Analysis**
- **Discriminant Analysis**



Difference Between Research Method and Research Methodology

Research can be understood as the systematic and rigorous search for appropriate information on a specific subject. It involves enunciation of the problem, developing a hypothesis, collecting and analysing data and drawing conclusions, based on the facts and data collected. And to do so, the researcher uses **research methods**, during the course of conducting research.

The research methods are often confused with **research methodology**, which implies the scientific analysis of the research methods, so as to find a solution to the problem at hand. Hence, it seems apt to clarify the differences between research method and research methodology at this juncture, have a look.

Content: Research Method Vs Research Methodology

Comparison Chart

Basis of Comparison	Research Method	Research Methodology
Meaning	Research Method implies the methods employed by the researcher to conduct research.	Research methodology signifies way to efficiently solving research problems.
What is it?	Behavior and instrument used in the selection and construction of the research technique.	Science of understanding, how research is performed methodically.
Encompasses	Carrying out experiment, test, surveys and so on.	Study different techniques which can be utilized in the performance of

Basis of Comparison	Research Method	Research Methodology
		experiment, test, surveys etc.
Comprise of	Different investigation techniques.	Entire strategy towards achievement of objective.
Objective	To discover solution to research problem.	To apply correct procedures so as to determine solutions.

Definition of Research Method

Research method pertains to all those methods, which a researcher employs to undertake research process, to solve the given problem. The techniques and procedure, that are applied during the course of studying research problem are known as the research method. It encompasses both qualitative and quantitative method of performing research operations, such as survey, case study, interview, questionnaire, observation, etc.

These are the approaches, which help in collecting data and conducting research, in order to achieve specific objectives such as theory testing or development. All the instruments and behaviour, used at various levels of the research activity such as making observations, data collection, data processing, drawing inferences, decision making, etc. are included in it. Research methods are put into three categories:

- **First Category:** The methods relating to data collection are covered. Such methods are used when the existing data is not sufficient, to reach the solution.
- **Second Category:** Incorporates the processes of analysing data, i.e. to identify patterns and establish a relationship between data and unknowns.
- **Third Category:** Comprise of the methods which are used to check the accuracy of the results obtained.

Definition of Research Methodology

Research Methodology, as its name suggest is the study of methods, so as to solve the research problem. It is the science of learning the way research should be performed systematically. It refers to the rigorous analysis of the methods applied in the stream of research, to ensure that the conclusions drawn are valid, reliable and credible too.

The researcher takes an overview of various steps that are chosen by him in understanding the problem at hand, along with the logic behind the methods employed by the researcher during study. It also clarifies the reason for using a particular method or technique, and not others, so that the results obtained can be assessed either by the researcher himself or any other party.

Key Differences Between Research Method and Research Methodology

The differences between research method and research methodology can be drawn clearly on the following grounds:

1. The research method is defined as the procedure or technique applied by the researcher to undertake research. On the other hand, research methodology is a system of methods, used scientifically for solving the research problem.
2. The research method is nothing but the behaviour or tool, employed in selecting and building research technique. Conversely, research methodology implies the science of analysing, the manner in which research is conducted appropriately.
3. The research method is concerned with carrying out experiment, test, surveys, interviews, etc. As against this, research methodology is concerned with learning various techniques which can be employed in the performance of experiment, test or survey.
4. Research method covers various investigation techniques. Unlike, research methodology, which consists of complete approach aligned towards the attainment of purpose.
5. Research method intends to discover the solution to the problem at hand. In contrast, research methodology aspires to apply appropriate procedures, with a view to ascertaining solutions.

Factor Analysis

Factor analysis is a technique that is used to reduce a large number of variables into fewer numbers of factors. This technique extracts maximum common variance from all variables and puts them into a common score. As an index of all variables, we can use this score for further analysis. Factor analysis is part of general linear model (GLM) and this method also assumes several assumptions: there is linear relationship, there is no multicollinearity, it includes relevant variables into analysis, and there is true correlation between variables and factors. Several methods are available, but principle component analysis is used most commonly.

Types of factoring:

There are different types of methods used to extract the factor from the data set:

1. **Principal component analysis:** This is the most common method used by researchers. PCA starts extracting the maximum variance and puts them into the first factor. After that, it removes that variance explained by the first factors and then starts extracting maximum variance for the second factor. This process goes to the last factor.
2. **Common factor analysis:** The second most preferred method by researchers, it extracts the common variance and puts them into factors. This method does not include the unique variance of all variables. This method is used in SEM.

3. **Image factoring:** This method is based on correlation matrix. OLS Regression method is used to predict the factor in image factoring.

4. **Maximum likelihood method:** This method also works on correlation metric but it uses maximum likelihood method to factor.

5. **Other methods of factor analysis:** Alfa factoring outweighs least squares. Weight square is another regression based method which is used for factoring.

Factor loading:

Factor loading is basically the correlation coefficient for the variable and factor. Factor loading shows the variance explained by the variable on that particular factor. In the SEM approach, as a rule of thumb, 0.7 or higher factor loading represents that the factor extracts sufficient variance from that variable.

Eigenvalues: Eigenvalues is also called characteristic roots. Eigenvalues shows variance explained by that particular factor out of the total variance. From the commonality column, we can know how much variance is explained by the first factor out of the total variance. For example, if our first factor explains 68% variance out of the total, this means that 32% variance will be explained by the other factor.

Factor score: The factor score is also called the component score. This score is of all row and columns, which can be used as an index of all variables and can be used for further analysis. We can standardize this score by multiplying a common term. With this factor score, whatever analysis we will do, we will assume that all variables will behave as factor scores and will move.

Criteria for determining the number of factors: According to the Kaiser Criterion, Eigenvalues is a good criteria for determining a factor. If Eigenvalues is greater than one, we should consider that a factor and if Eigenvalues is less than one, then we should not consider that a factor. According to the variance extraction rule, it should be more than 0.7. If variance is less than 0.7, then we should not consider that a factor.

Rotation method: Rotation method makes it more reliable to understand the output. Eigenvalues do not affect the rotation method, but the rotation method affects the Eigenvalues or percentage of variance extracted. There are a number of rotation methods available: (1) No rotation method, (2) Varimax rotation method, (3) Quartimax rotation method, (4) Direct oblimin rotation method, and (5) Promax rotation method. Each of these can be easily selected in SPSS, and we can compare our variance explained by those particular methods.

Assumptions:

1. **No outlier:** Assume that there are no outliers in data.

2. **Adequate sample size:** The case must be greater than the factor.
3. **No perfect multicollinearity:** Factor analysis is an interdependency technique. There should not be perfect multicollinearity between the variables.
4. **Homoscedasticity:** Since factor analysis is a linear function of measured variables, it does not require homoscedasticity between the variables.
5. **Linearity:** Factor analysis is also based on linearity assumption. Non-linear variables can also be used. After transfer, however, it changes into linear variable.
6. **Interval Data:** Interval data are assumed.

Key concepts and terms:

Exploratory factor analysis: Assumes that any indicator or variable may be associated with any factor. This is the most common factor analysis used by researchers and it is not based on any prior theory.

Confirmatory factor analysis (CFA): Used to determine the factor and factor loading of measured variables, and to confirm what is expected on the basis or pre-established theory. CFA assumes that each factor is associated with a specified subset of measured variables. It commonly uses two approaches:

1. **The traditional method:** Traditional factor method is based on principle factor analysis method rather than common factor analysis. Traditional method allows the researcher to know more about insight factor loading.
2. **The SEM approach:** CFA is an alternative approach of factor analysis which can be done in SEM. In SEM, we will remove all straight arrows from the latent variable, and add only that arrow which has to observe the variable representing the covariance between every pair of latents. We will also leave the straight arrows error free and disturbance terms to their respective variables. If standardized error term in SEM is less than the absolute value two, then it is assumed good for that factor, and if it is more than two, it means that there is still some unexplained variance which can be explained by factor. Chi-square and a number of other goodness-of-fit indexes are used to test how well the model fits.

Discriminant Analysis

Discriminant analysis is a technique that is used by the researcher to analyze the research data when the criterion or the dependent variable is categorical and the predictor or the independent variable is interval in nature. The term categorical variable means that the dependent variable is divided into a number of categories. For example, three brands of computers, Computer A, Computer B and Computer C can be the categorical dependent variable.

The objective of discriminant analysis is to develop discriminant functions that are nothing but the linear combination of independent variables that will discriminate between the

categories of the dependent variable in a perfect manner. It enables the researcher to examine whether significant differences exist among the groups, in terms of the predictor variables. It also evaluates the accuracy of the classification.

Discriminant analysis is described by the number of categories that is possessed by the dependent variable.

As in statistics, everything is assumed up until infinity, so in this case, when the dependent variable has two categories, then the type used is two-group discriminant analysis. If the dependent variable has three or more than three categories, then the type used is multiple discriminant analysis. The major distinction to the types of discriminant analysis is that for a two group, it is possible to derive only one discriminant function. On the other hand, in the case of multiple discriminant analysis, more than one discriminant function can be computed.

There are many examples that can explain when discriminant analysis fits. It can be used to know whether heavy, medium and light users of soft drinks are different in terms of their consumption of frozen foods. In the field of psychology, it can be used to differentiate between the price sensitive and non price sensitive buyers of groceries in terms of their psychological attributes or characteristics. In the field of business, it can be used to understand the characteristics or the attributes of a customer possessing store loyalty and a customer who does not have store loyalty.

For a researcher, it is important to understand the relationship of discriminant analysis with Regression and [Analysis of Variance \(ANOVA\)](#) which has many similarities and differences. Often we can find similarities and differences with the people we come across. Similarly, there are some similarities and differences with discriminant analysis along with two other procedures. The similarity is that the number of dependent variables is one in discriminant analysis and in the other two procedures, the number of independent variables are multiple in discriminant analysis. The difference is categorical or binary in discriminant analysis, but metric in the other two procedures. The nature of the independent variables is categorical in Analysis of Variance (ANOVA), but metric in regression and discriminant analysis.

The steps involved in conducting discriminant analysis are as follows:

- The problem is formulated before conducting.
- The discriminant function coefficients are estimated.
- The next step is the determination of the significance of these discriminant functions.
- One must interpret the results obtained.
- The last and the most important step is to assess the validity.

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